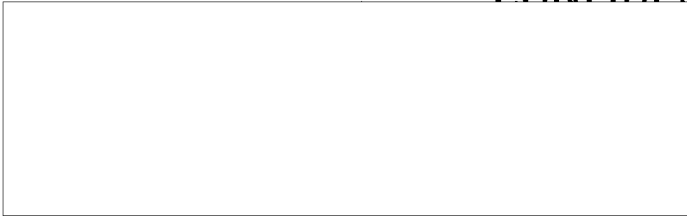


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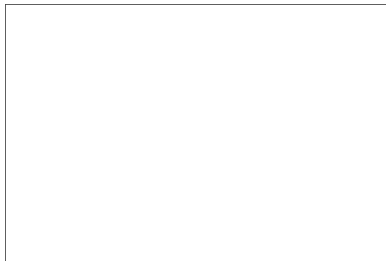
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11 October 1960

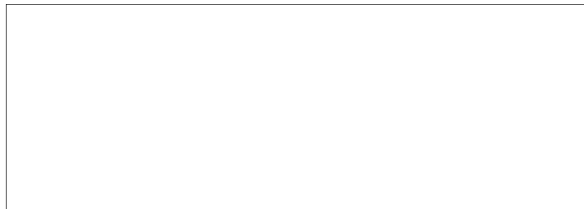
TIMER, NUCLEAR, JCR/



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A proposal is hereby submitted (in duplicate)
for a new program of work on nuclear timers. We shall be
looking forward to your reply.

Very truly yours,

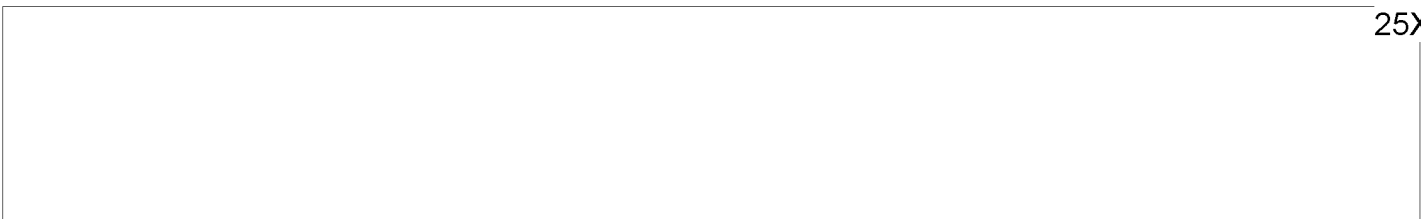


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Vice President and
Director of Research

AB:mn

Encl (cited above)



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Proposal to Manufacture and Test Nuclear Timers**INTRODUCTION**

and the Government have cooperated in developing an electronic timer circuit incorporating a Kr 85 nuclear battery. In the most recent phase of this program (Task 2), a number of breadboard and packaged timers were prepared and operated successfully at timing intervals of 2 to 24 hours.

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nuclear delay timer utilizes a capacitor charge and discharge cycle. A special discharge diode fires at a pre-arranged voltage, delivering the energy stored in the capacitor to the coil in a mechanical counter or (after the last count) to another system. The voltage and current output of the nuclear battery are regulated to insure a reproducible and linear charging curve. The capacitor, discharge diode, voltage regulator, and current regulator are all manufactured at specially for this application.

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A set of requirements has recently been provided for an operational timing device using this circuit and components. This proposal outlines a plan of work to be done at leading to an evaluation of the practicability of these specifications through manufacture and test of a limited quantity of prototypes. Among the criteria to be applied to these prototypes are: consistency of timing over a wide range of temperatures, compatibility with related equipment, and continued or fail-safe operation after vibration and other types of rough handling.

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It is estimated that the objectives of this program can be accomplished in one year at a cost of \$61,370.00.

SCOPE

1. The timer will be packaged to meet the requirements provided by the contracting officer, including compatibility of the container and connections with associated equipment. Certain components may be potted for safety, to reduce electrical leakage, or to relieve mechanical strain. It is anticipated that several packaging designs may be evaluated under actual performance conditions and given preliminary environmental tests before the actual prototypes are manufactured.

2. Moderate production runs of appropriate sizes of capacitors, voltage regulators, current regulators, discharge diodes, and Kr 85 nuclear batteries will be carried out. Each individual component will be tested in the manner developed in the previous phase of this program to enable a selection of the most satisfactory pieces. Sodeco counters will be modified to meet the size requirements, and coils will be wound to the optimum inductance in the Sodeco Laboratory or by other coil-winding specialists under [] direction.

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3. Using components manufactured or modified as described above, or procured from the best commercial sources, at least 20 complete and operating prototypes will be assembled according to the most successful packaging design.

4. The timing cycles of the 20 prototypes will be monitored by automatic

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recording equipment for such time as may be necessary to determine their accuracy. Final adjustments of the packaging design or exchange of components may be made at this time. However, at least 2 months of satisfactory operation at room temperature (approximately 30 timing cycles, with $\pm 1\%$ precision) after the last modification will be required of each unit before it is released for environmental testing.

5. A selection of 10 successful prototypes will be subjected to severe environmental and mechanical tests according to the requirements furnished by the contracting officer. These will include operation at various temperatures, under water, and after vibration and drop tests, as specified. Timing interval accuracy and precision will be monitored again after these tests, and the individual units will be inspected for evidence of damage and the causes of any failure determined.

REPORT AND DRAWINGS

A final report will be provided at the conclusion of the program. It will include a comprehensive review of the work, timing data on prototypes, reproducible drawings, conclusions and recommendations.

COMPONENTS TO BE FURNISHED

Radiation Research Corporation will be furnished, as necessary, special electrical coupling bases, and such environmental test equipment as a vibration table and apparatus to control temperature and humidity.

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ESTIMATED COST BREAKDOWN**ONE YEAR PROGRAM**

<u>Direct Labor</u>	<u>Hours</u>	<u>Rate</u>	<u>Amount</u>
Director of Research	400	\$5.55	\$ 2,220
Senior Electrical Engineer	1200	5.00	6,000
Engineer	1200	4.00	4,800
Technician	800	2.75	2,200
Machinist	800	3.00	<u>2,400</u>
Sub Total			\$17,620
Overhead, at 180%			31,700
Materials			<u>7,500</u>
Sub Total			\$56,820
Fee, at 8%			<u>4,550</u>
TOTAL			<u><u>\$61,370</u></u>

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